



AUKE LAKE WATER QUALITY MONITORING

JULY 2, 2012 – JUNE 30, 2013

This Final Report was prepared for the Alaska Department of Environmental Conservation as part of the Alaska Clean Water Actions Grant # ACWA 13-08 (FY13).



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INTRODUCTION

Auke Lake is located in the Auke Bay area, 10 miles northwest of Juneau, AK. The Auke Lake watershed drains an area of 2,500 acres, and the lake itself has a surface area of approximately 177 acres and a maximum depth of 113 feet. The lake's outlet is Auke Creek, which discharges into Auke Bay. Its headwaters include Lake Creek, Lake Two Creek and unnamed drainages from Goat Hill and Peterson Hill. The lake is an anadromous system supporting coho, sockeye, pink and chum salmon, as well as cutthroat and rainbow trout and Dolly Varden char (Bethers, 1995). The undeveloped areas of the Auke Lake watershed include Sitka spruce and Western hemlock forest intermixed with wetlands, which support a variety of wildlife including a variety of water fowl and birds, beavers, river otters, Sitka black-tailed deer, and black bear.

Auke Lake is one of the few freshwater lakes easily accessible by the road system. Its accessibility makes it a popular recreational area for uses including swimming, motorized and non-motorized boating, hiking, running, and biking.

The boat launch and parking area, located at the southwest corner of the lake, is a designated City and Borough of Juneau (CBJ) Recreation Service Park. Auke Lake Trail is a CBJ owned trail that parallels the western edge of the lake, and provides access to a floating dock.

There has been concern about the effect of motorized water craft use on Auke Lake's water quality. This concern has prompted water quality studies to assess PAH concentrations in relation to recreational use of the lake. NOAA/NMFS conducted periodic water quality sampling in Auke Lake from 1999 to 2003 for polycyclic aromatic hydrocarbon (PAH) discharges, in tandem with daily recreational boating observations. That study showed an increase in PAH concentrations in surface waters of Auke Lake coincided with the increase of two-stroke engine water craft on the lake.

Using Alaska Clean Water Act (ACWA) funds, the JWP was able to continue the monitoring of the recreational usage on the lake and its effect on the water quality of the lake.

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AUKE LAKE MONITORING LOCATIONS

Sampling/monitoring locations for the Auke Lake monitoring project are based on historic sampling locations noted in Rice (2008) as well as observed points of congestion and use on Auke Lake. Table 1 provides the monitoring coordinates and site descriptions for each location, Table 2 describes the rationale for choosing each monitoring location and comparison to the Rice (2008) collection sites, and Figure 1 is an aerial view of Auke Lake superimposed with the sampling locations for this project. The non-motorized use designation located near the homeowners' area on the north end of the lake is also depicted on the map.

Table 1: Monitoring Locations and Site Descriptions

Site ID	Latitude	Longitude	Site Description
AL1	58°22'55"N	134°38'1"W	Auke Lake Boat Launch. High traffic area.
AL2	58°23'7"N	134°37'58"W	Central Lake, Center of Boat Traffic. General Conditions. Used in Rice (2008).
AL3	58°22'24"N	134°37'52"W	Homeowner Area.
AL4	58°22'56"N	134°37'46"W	Floating Dock. Area of congestion. Used in Rice (2008).

Table 2: Monitoring Site Rationale

Site ID	Monitored Parameter	Site Description
AL1	TAH in a high use area	Auke Lake Boat Launch. High Traffic area. Frequently used for fueling and maintenance of personal watercraft during high use periods.
AL2	TAH in a medium use area	Central Lake. General conditions. Used in Rice (2008).
AL3	TAH in a low use area	Homeowner Area. Designated non-motorized.
AL4	TAH in a high use area	Floating Dock. Area of congestion. Used in Rice (2008)

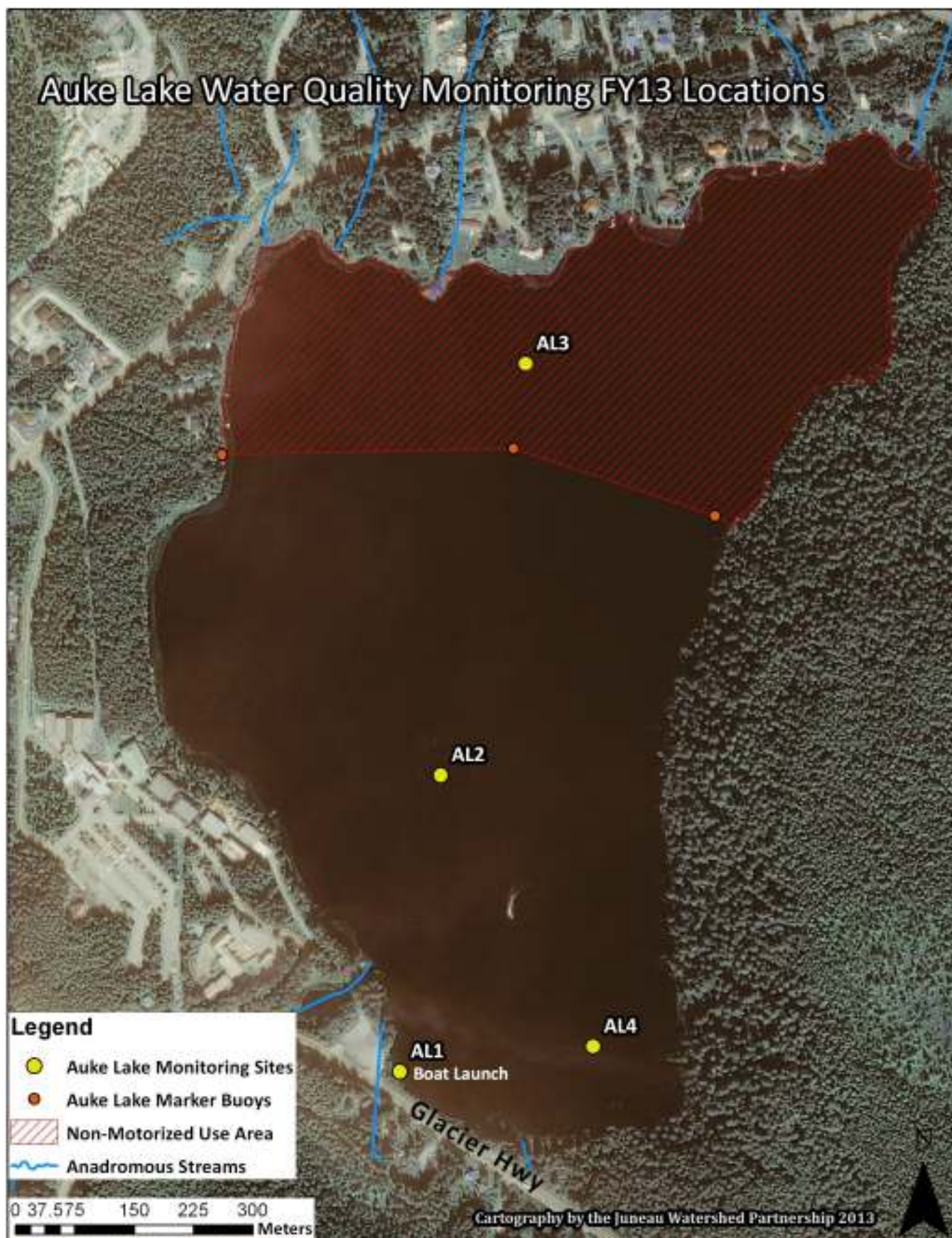


Figure 1: Sample sites for the Auke Lake water quality monitoring project

METHODS

Samples were collected for the Auke Lake water quality monitoring project at four (4) different sample locations on Auke Lake (see Figure 1). All of the sampling was conducted during the summer of 2013 prior to the end of the fiscal year, June 30, 2013. Samples were collected from the four pre-determined locations during seasonal peak activity periods on Auke Lake. Often, the highest period of activity occurs on warm, calm and sunny days during the week days after professional work hours, when a large amount of use is concentrated on the lake at the same time. Use on the weekends during nice weather occurred, but not in concentrations comparable to most of the weekdays.

Samples from Auke Lake were collected to determine TAH concentrations and additional field parameters were collected at the four (4) sites on Auke Lake. All samples were collected by Juneau Watershed Partnership staff following Standard Operating Procedures as described in the Auke Lake Tier II Water Quality Monitoring QAPP. Trained staff collected water samples using an inflatable zodiac watercraft to travel around the lake (see Figure 2).



Figure 2: Inflatable zodiac raft used for sample collection.

Trained staff collected water samples with sterile sampling gloves changed between each sampling site. Water samples were collected about 0.15 meters below the surface of the water to avoid collecting surface scum. During sampling at each location notes were taken on observations of lake use and activity, wildlife, weather, and potential sources of pollution.

TAH samples were collected using a stainless steel, non-contaminating Wildco volatile organic compound (VOC) sampler. The VOC sampler weighs 11 lbs. and was suspended from a chain during sample collection at a depth of 0.15 meters. Figure 3 shows the Wildco sampler being lowered to collect a TAH sample on Auke Lake. The sampler collects a sample at a single point in a stream or lake and is designed to evacuate air and other gases before collecting a sample. Four (4) 40-mL glass vials are placed inside of the sampler and copper tubes extend to the bottom of each vial from the inlet ports on top of the sampler. The vials fill and overflow into the sampler body, displacing air in the vials and in the sampler through the exhaust tube. The total volume of the Wildco sampler is eight times larger than the vials; therefore, the vials are flushed seven times (removing the air) before the final volume is retained in the vial. After the sampler is finished filling up, the lid is carefully removed and the vials are slowly lifted from the sampler reservoir, ensuring not to lose the convex meniscus. Two to three drops of 1:1 HCl were added to each sample vial to lower the pH to less than 2, and the vials were capped. The vials were agitated and checked for air bubbles; samples were discarded if bubbles were present. Three vials from the same sampler set are required for one complete sample, and a resample was collected if more than two vials were discarded due to air present. All TAH samples were put on ice immediately following sample collection (see Figure 4).



Figure 3: Wildco VOC sampler being lowered into Auke Lake to collect a TAH sample.

Field parameter samples were each collected into a 500 ml high-density polyethylene (HDPE) sample bottle using a peristaltic pump at a depth of 0.15 meters. Field measurements were analyzed in-situ immediately after sample collection using a Hach 40d rugged portable multi-parameter meter. A field replicate was collected from one site per sampling period on a rotating schedule so that replicates were collected from each sampling site. Temperature blanks accompanied all coolers to ensure that samples remained within acceptable limits.



Figure 4: Wildco VOC sampler and VOC sample vials on ice immediately after sample collection.

Test America, Inc., located in Seattle, WA, performed analyses of TAH using EPA Method 624, including BTEX. Test America provided all sampling bottles, materials, and coolers. After collection samples were stored in a cooler between 1 and 6 degrees Celsius and were shipped to Test America via Fed Ex Standard Overnight the following day after sample collection. Laboratory staff at Test America checked each temperature blank upon receipt to ensure that samples were delivered less than 6 degrees Celsius, as required by the standard method for VOC analysis.

Field Forms and the COC were scanned and emailed to Gretchen Pikul, the DEC contact and project manager. All field data was entered into a MS Excel spreadsheet and supplied to the DEC. Data was then reviewed for quality control and assurance by DEC staff and ultimately uploaded to the state Alaska Water Quality Monitoring System (AQWMS) database.

RESULTS

The four (4) Auke Lake sampling sites were sampled three (3) times during the summer of 2013 in FY2013. Graphs for measured field parameters and TAH results are listed in the Appendix to this report. Samples were collected during high use periods on the lake during sunny and warm-weathered days in order to determine whether Auke Lake currently meets state water quality standards.

Auke Lake has been identified by the Alaska Clean Water Action program as being a water of concern for degradation by petroleum hydrocarbons associated with personal watercraft and motor boat usage. The applicable State Water Quality Standard (WQS) for the growth and propagation of fish, shellfish, other aquatic life and wildlife states that “Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 ug/l.” The water quality criteria for toxics and other deleterious substances specific to this project, specifically the individual BTEX compound limits, are shown in Table 3 below. Out of the three (3) sampling events in June 2013, only one of the events returned a positive TAH result. The TAH results are summarized in Table 4 below. Site AL1, the CBJ Boat Launch, reported a result of 20 ug/L, which exceeds the Alaska water quality standard of 10 ug/l. Site AL2 had a concentration of TAH reported as 1.3 ug/l, which is below the limit of 10 ug/l. Both of these positive results occurred during the sampling event on June 24, 2013.

Table 3: Water Quality Criteria for Toxics and Other Deleterious Substances specific to this project

Chemical of Concern	Type of Pollutant	Water Use	µg/L (unless reported otherwise)	
Benzene	VOC	Drinking Water	5	
Ethylbenzene	VOC	Drinking Water + Aquatic	700	3,100
Toluene	VOC	Drinking Water + Aquatic	1,000	6,800
Xylene (total)	VOC	Drinking Water	10,000	

Table 4: Summary of TAH results

Sampling Location	Total # of Samples	TAH Results (ug/L)*		
		6/11/13	6/19/13	6/24/13
AL1	3	<1	<1	20
AL2	3	<1	<1	1.3
AL3	3	<1	<1	<1
AL4	3	<1	<1	<1

*Reporting Limit= 1 ug/L

Alaska WQS= 10 ug/L

Field parameters were measured at each site alongside the TAH sampling. The graphs for each of these field parameters are available in the appendix to this document. Overall, there appeared to be slight increases in the water temperatures throughout the month, which can be attributed to the surface lake water warming with the temperatures of summer and the increasingly warmer temperatures that Juneau experienced during the month of June. Most of the water temperatures were greater than 20 degrees Celsius, which is the Alaska Water Quality standard for waters available to support aquatic life. The conductivity values ranged from 24 uS/cm to 91.8 uS/cm, all values which support aquatic life in freshwater systems. All pH values for sites AL1, AL2, AL3 and AL4 ranged between 6.5 and 8.5, the water quality standard put forth by the State of Alaska to support aquatic life. Dissolved Oxygen (DO) values for sites AL1, AL2, AL3 and AL4 are all within the greater than 7 mg/L standard DO concentrations recommended for anadromous fish habitat.

Using ACWA funds the JWP is continuing the water quality monitoring in FY14.

PUBLIC OUTREACH

The Juneau Watershed Partnership wrote and published an article about the Auke Lake water quality monitoring project in our “Stream Scene” Newsletter in May 2013. Also, the JWP staff was able to talk to the public during sampling events at Auke Lake and at the Wild and Scenic Film Festival in February 2013 explaining the background of the project. A comprehensive project write-up will also be featured in our upcoming issue of our “Stream Scene” Newsletter in August/September 2013, wrapping up the sampling project for FY13 and providing a synopsis of sampling results.

ACKNOWLEDGEMENTS

The Juneau Watershed Partnership thanks Gretchen Pikul (ADEC) for her support and patience during the development and implementation of this program.

APPENDIX

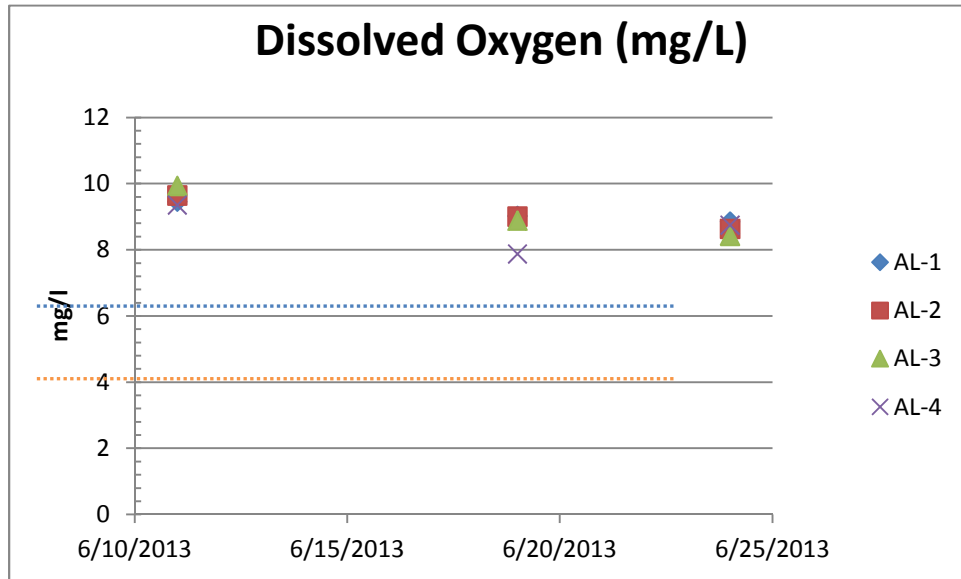


Figure 1: Dissolved Oxygen (DO) values from Auke Lake water quality monitoring during FY 2013. Alaska Water Quality Standards call for > 7 mg/l for anadromous fish; > 5 mg/l for non-anadromous fish; < 17 mg/l for aquatic life (the dotted lines correlate to DO concentrations required for healthy fish populations).

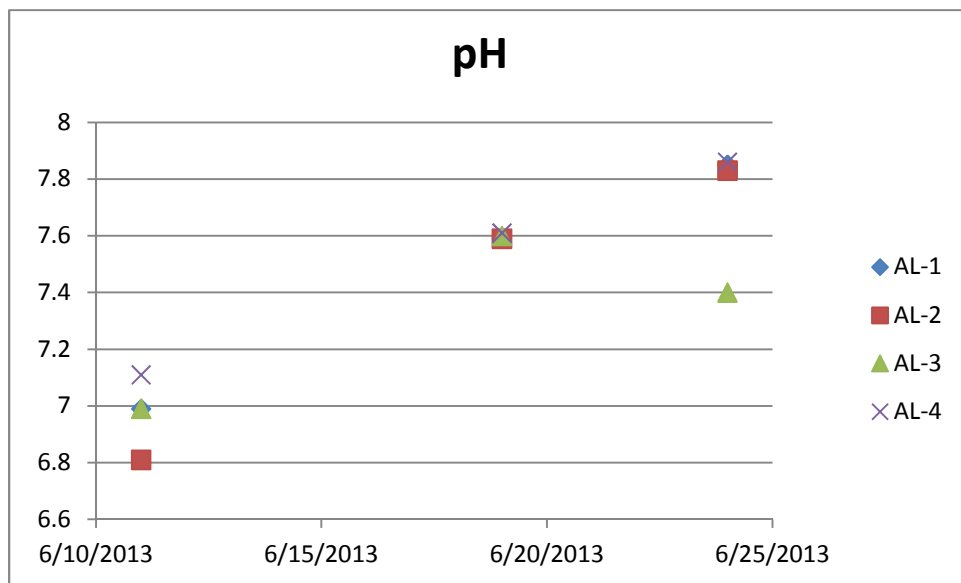


Figure 2: pH values from Auke Lake water quality monitoring during June 2013. Alaska Water Quality Standards call for pH values ranging from 6.5 to 8.5 to support aquatic life.

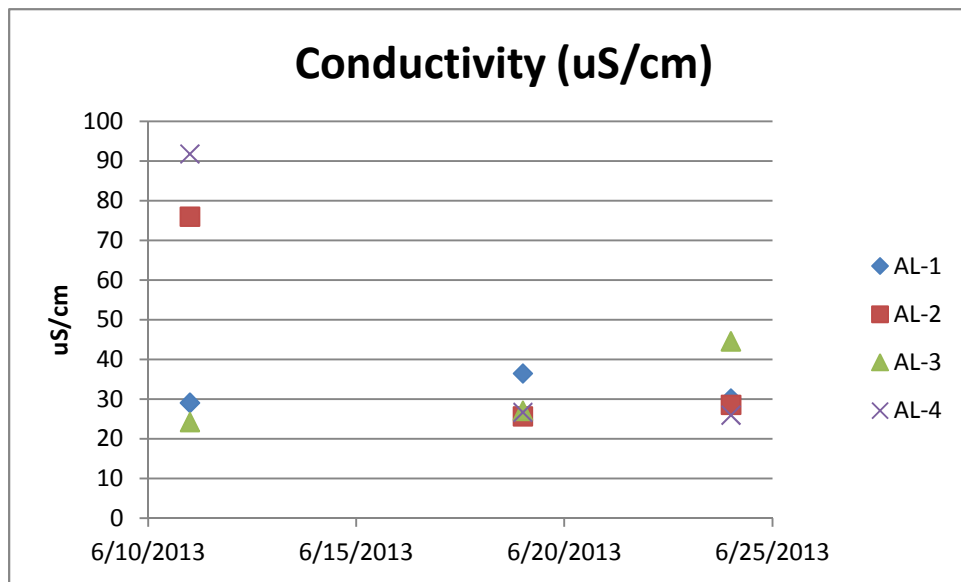


Figure 3: Conductivity values from Auke Lake water quality monitoring during June 2013.

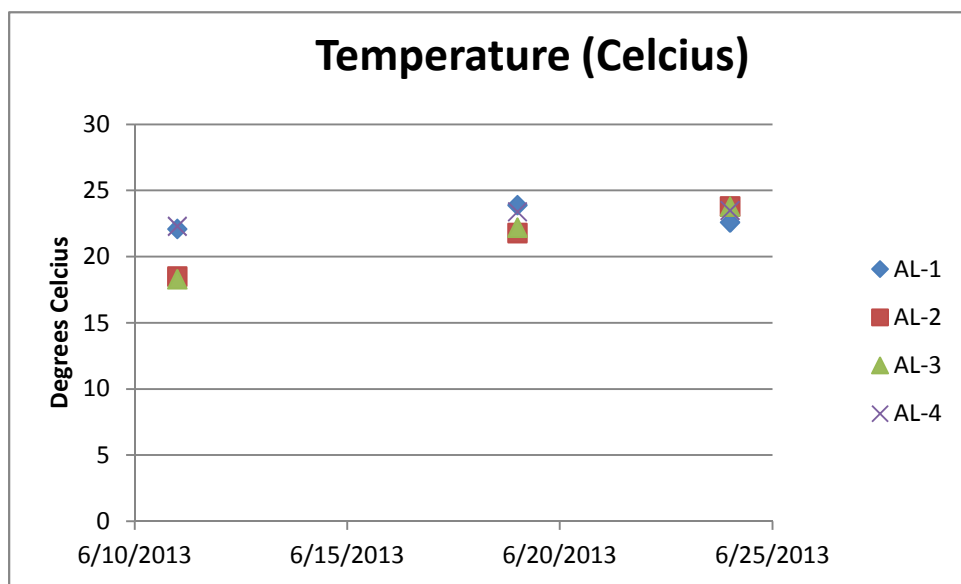


Figure 4: Temperature values from Auke Lake water quality monitoring during June 2013. Alaska Water Quality Standards call for temperatures < 20 degrees Celsius to support aquatic life.

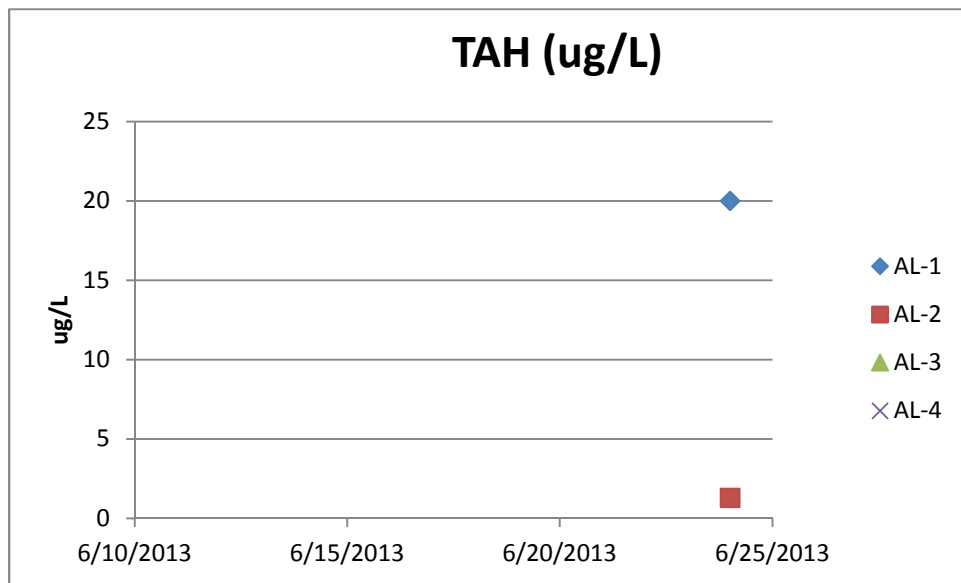


Figure 5: TAH values above the Method Detection Limit (MDL) from Auke Lake water quality monitoring during June 2013. Of the three (3) sampling events on Auke Lake only 2 samples yielded positive TAH results above the MDL. Alaska Water Quality Standards call for TAH values less than 10ug/l to support healthy aquatic life.